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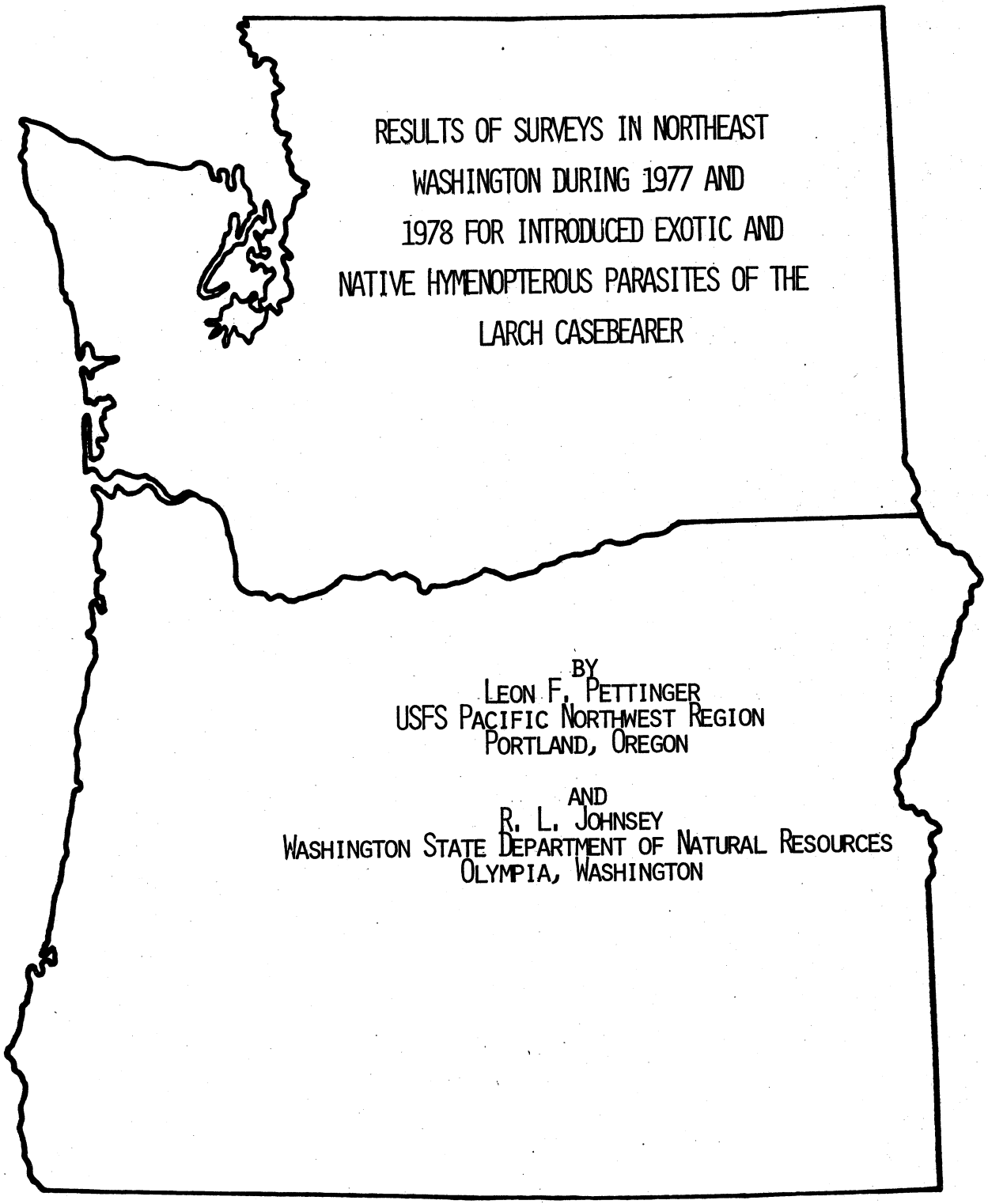

RESULTS OF SURVEYS IN NORTHEAST WASHINGTON DURING 1977 AND 1978 FOR INTRODUCED EXOTIC AND NATIVE HYMENOPTEROUS PARASITES OF THE LARCH CASEBEARER

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INTRODUCTION

The larch casebearer, *Coleophora laricella* (Hubner) was first discovered in eastern United States in the late 19th century. Two introduced exotic parasites have been given credit for substantial control of larch casebearer in the East (DeBach 1964). The casebearer was discovered in the West in 1957 near St. Maries, Idaho (Denton and Tunnock 1972). Since then, the insect has spread to all areas in the western United States where its host, western larch is native.

Several species of parasites, native to the Northwest, have crossed over from native hosts to parsitize the larch casebearer. However, none of these parasites have reached numbers high enough to exert effective control of the larch casebearer.

In 1960 the first introduced exotic parasite *Agathis pumila* (Ratz.) was released in the West near St. Maries, Idaho, for biological control of the casebearer. In 1964 and 1965 additional importation and releases were made near Sandpoint, Idaho (Terrell and Denton 1965). First release of this same insect in Washington State was made in 1966. Since 1966, three other exotic parasite species have been introduced into the northeast Washington larch casebearer population.

INTRODUCED EXOTIC PARASITE RELEASES

Agathis pumila (Ratz.).

Since its initial release in Idaho *A. pumila* has been widely distributed throughout the range of western larch in the West. In Washington, *A. pumila* was released in 1966 at eleven locations in Ferry, Spokane, and Stevens Counties. In 1967, 1968, and 1969 the parasite was released at an additional 49 locations throughout northeast Washington (Bousfield et al. 1974). All of these releases were made using immature parasites within the overwintering larch casebearer larvae. An estimated 5,000 parasites were released at each release site. Sex of released parasites was not determined (Table 1). No adults of *A. pumila* have been released in northeast Washington. All *A. pumila* released were progeny of the releases made in Idaho in 1964 and 1965.

Chrysocharis laricinellae (Ratz.)

First release of *C. laricinellae* in the western United States was made near Moscow, Idaho in 1972 (Ryan and Denton, 1973). In northeast Washington first releases were made in 1973 and 1974 using parasites collected in Wisconsin. Parasites were released as adults with several releases being made throughout the seasons of larch casebearer activity. Exact dates of releases and sources are given by Ryan et. al. (1975). All releases were made at the Twin Lake site on the Colville Indian Reservation about 5 miles west of Inchelium. A total of 2,422 parasites was released, with 1,327 being female and 1,095 male. It is possible that this parasite and others may have been accidentally or unknowingly introduced at times and places other than those recorded in the literature. Evidence of this is the report of *C. laricinellae* collection from Hope, Idaho in 1972. This collection is well over 100 miles distance from the Moscow release site. Other collections of this parasite were made in Montana in 1973.

Necremnus metalarus (Walk.)

This parasite was released several times during the months of casebearer activity in 1974, 1975, and 1976. The parasite strain originated in Austria-northern Italy (Ryan et. al. 1975, 1977). Parasites were all released at the Twin Lake site. During the 3 year period, 1,584 adult parasites were released at the site and all but four of these were female. A low incidence of males is common in this species, because females reproduce asexually and yield mostly female progeny (Ryan 1979).[1/]

Elachertus argissa (Walk.)

At the Twin Lake site, 556 *E. argissa* from Austria-northern Italy were released during the 3 years--1974, 1975, and 1976. (Ryan, et. al. 1975, 1977). Females outnumbered males by 493 to 63. Adults only were released during the casebearer's susceptible stages. As in the case of *N. metalarus*, reproduction in this species is asexual, yielding mostly female progeny (Ryan 1979).[1/]

1/ Ryan, R. B. Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, Oregon 97331. Personal Communications. March 1979.

Table 1.--SUMMARY OF INTRODUCED PARASITE RELEASES IN NORTHEAST WASHINGTON

Parasite and Year of Release	Number Release Sites
A. pumila[1/]	
1966	11
1967	9
1968	5
1969	35
All years	60

	Number of males released	Number of females released	Total Parasites Released
C. laricinellae[2/]			
1973	687	792	1,479
1974	408	535	943
All years	1,095	1,327	2,422
N. metalarus[2/]			
1974	1	1,221	1,222
1975	2	326	328
1976	1	33	34
All years	4	1,580	1,584
E. argissa[2/]			
1974	7	102	109
1975	35	357	392
1976	21	34	55
All years	63	493	556

1/ All released as immature parasites in overwintering casebearer larva. Estimated number of parasites released at each site is 5,000. Sex of released parasites not determined.

2/ All released as adult parasites. All released at the Twin Lake site, 5 miles west of Inchelium, Washington.

SURVEY METHODS

Sixteen locations were sampled in northeast Washington for all parasites. Fourteen of these sample locations were where *Agathis pumila* (Ratz.) had been released in the years 1966 to 1969. Two locations, Sullivan Lake and Disautel, were sampled as check sites where no introduced parasites have been released and are at least 20 miles from a release site. One of the survey locations was the Twin Lake site where all four introduced parasites have been released and the only location where *Chrysocharis laricenellae* (Ratz.), *Elachertus argissa* (Walker), and *Necremnus metalarus* (Walker) have knowingly been released (Figure 1).

Sampling was done in late May through early June when the larch casebearer was in the pupal stage. Ten western larch trees from each location were selected as sample trees. Each had a population of larch casebearer and were of a size that could be sampled with a standard pole pruner. Four branch tips were clipped from each tree. One branch was clipped from the top one-third of the living crown, two branches from the mid one-third of the living crown and one from the bottom one-third. From each sample branch, ten pupating larch casebearers were collected and placed in a 40 mm. plastic petri dish for parasite emergence. If any branch did not contain a minimum of ten live pupating larch casebearers, then additional branch tips were cut from that crown third until the ten casebearers had been collected.

After a rearing period when all insects had emerged, all were removed from the petri dish. Casebearer moths were counted and discarded while parasites were preserved in alcohol for later identification. All casebearer pupae that failed to produce a moth or a parasite was dissected to determine cause of death.

SURVEY RESULTS

Introduced Parasites

Agathis pumila (Ratz.).

A. pumila has been established in northeast Washington. However, surveys have shown the insect to be slow to increase numbers and slow to spread to new areas. By 1974, 8 years after its initial release, *A. pumila* had been found at least one time on only 42.8 percent of the release sites sampled in northeast Washington (Bousfield et al., 1974). In the 1977 and 1978 surveys it was found at only four of the 16 sites surveyed. The parasite has never been found at the check sites at Sullivan Lake and Disautel where introduced parasites have never been released. In 1977 and 1978 the highest rate of parasitism in northeast Washington by *A. pumila* was 2.6 percent (Table 2).

Chrysocharis laricinellae (Ratz.).

C. laricinellae is now well established and invading new areas in northeast Washington. Establishment has progressed faster than any other introduced parasite in northeast Washington. On the 16 plots surveyed during 1977 and 1978, *C. laricinellae* was found on all but one. The parasite was found at both the Sullivan Lake and Disautel check sites. At the original release site of Twin Lake, the percent parasitism by the insect was not noticeably different than at any other sample site. The highest percent parasitism found in the 2 years of survey was 22.1 percent in 1977 at the Friedlander site on the Colville Indian Reservation approximately 15 air miles from the release site at Twin Lake. In 1978 this same site had a parasitism rate by *C. laricinellae* of 0.5 percent (Table 2).

Elachertus argissa (Walker).

E. argissa may be established in northeast Washington. One specimen was collected in 1977 on the Friedlander site about 15 miles from its release location at Twin Lake in September 1974. In 1978 no specimens of this parasite were collected at the site. *E. argissa* was not recovered at the Twin Lake release site in 1977 or 1978.

Necremnus metalarus (Walker).

N. metalarus has never been recovered on subsequent surveys since its release. If this parasite is established, it is not yet showing up on surveys.

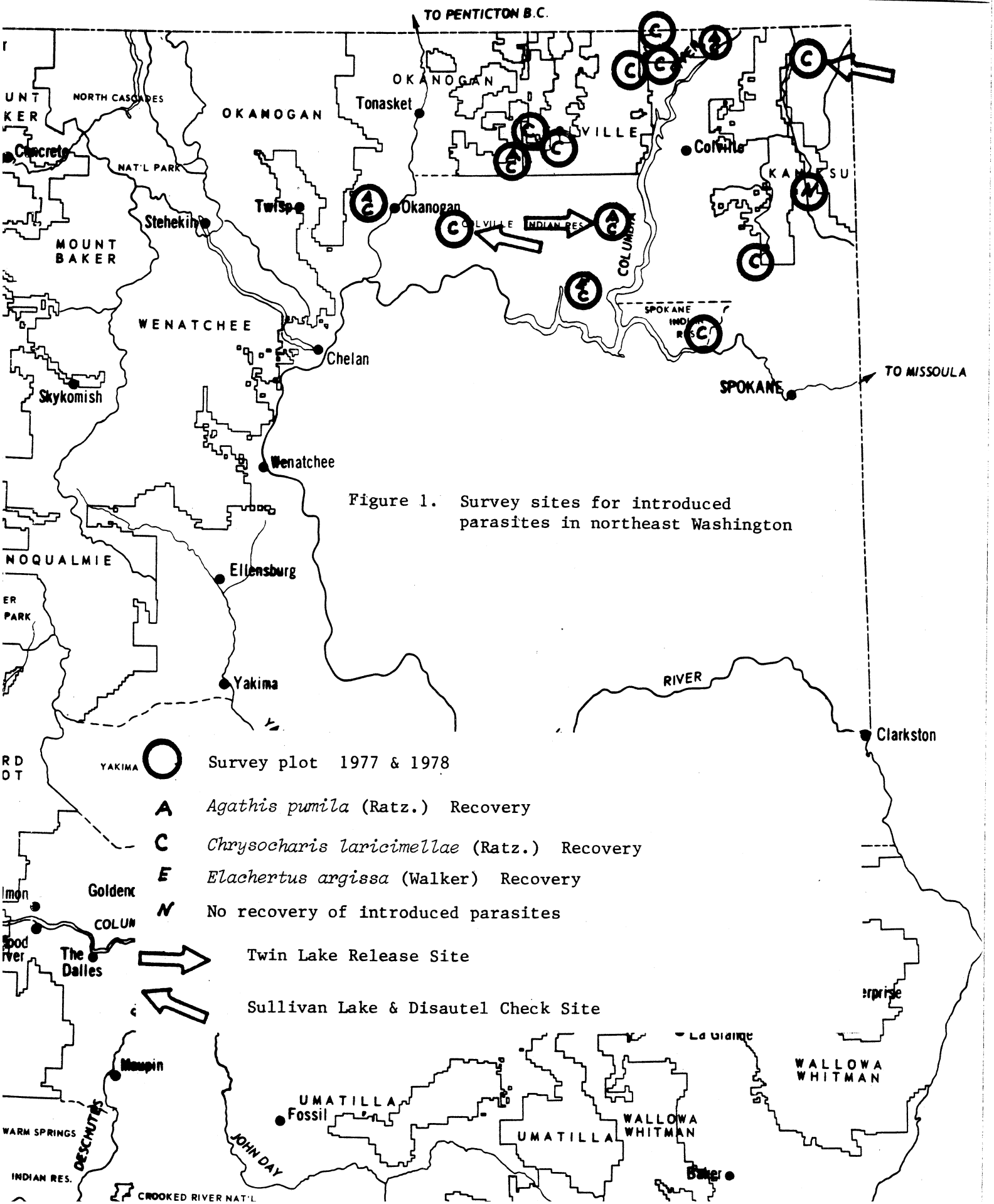

Figure 1. Survey sites for introduced parasites in northeast Washington

Table 2.-- PERCENT PARASITISM DURING 1977 AND 1978 OF LARCH CASEBEARER BY INTRODUCED PARASITES

AREA	LOCATION T.	R.	Sec.	*A. pumila* 1977	*A. pumila* 1978	*C. laricinellae* 1977	*C. laricinellae* 1978	*N. metalarus* 1977	*N. metalarus* 1978	*E. argissa* 1977	*E. argissa* 1978
Boulder	39N	36E	36	0	0	0	0.8	0	0	0	0
Locke	34N	44E	7	0	0	0	0	0	0	0	0
Twin Lake[1/]	32N	36E	8	0.5	2.6	6.2	1.5	0	0	0	0
Disautel[2/]	32N	29E	11	0	0	7.7	0.2	0	0	0	0
Sullivan Lake[2/]	39N	43E	26	0	0	6.6	0.7	0	0	0	0
Sheep Creek	40N	39E	23	0	1.5	2.8	5.3	0	0	0	0
Cottonwood	28N	39E	6	0	0	0.8	0.2	0	0	0	0
Friedlander	30N	34E	24	0	0	22.1	0.5	0	0	0.9	0
Loup Loup[3/]	33N	25E	18	-	0.2	-	1.1	-	0	-	0
Cottonwood Creek[3/]	31N	41E	12	-	0	-	0.3	-	0	-	0
W. Fork Sanpoil[3/]	35N	31E	23	-	0.3	-	1.0	-	0	-	0
Orient-Cummins Rd.[3/]	40N	37E	34	-	0	-	1.3	-	0	-	0
Orient-Camp Creek[3/]	40N	37E	9	-	0	-	0.5	-	0	-	0
Kettle Falls[3/]	36N	36E	29	-	0	-	1.1	-	0	-	0
Republic-Hallcreek Rd.[3/]	36N	33E	32	-	0	-	13.8	-	0	-	0
Republic-Swan Lake[3/]	36N	32E	3	-	0	-	7.6	-	0	-	0

1/ Release site for *C. laricinellae*, *N. metalarus*, and *E. argissa*
2/ Check plots. No introduced parasites released at these two locations
3/ Not sampled in 1977

NATIVE PARASITES

Native parasites have generally had little effect on the host populations. With only one exception, all areas sampled showed a total parasitism rate of less than 10 percent (Table 3). However, one should view these parasitism rates with the knowledge that the life cycles and biologies of many of these parasites are generally unknown. An example of how these rates can be misleading is the Friedlander site and the native parasite *Spilochalcis albifrons*. In 1978 this site was sampled approximately two weeks later than the other sites. *S. albifrons* is a parasite of the pupal stage. Sampling late in the host pupal stage would reflect the full effect of this parasite on the host population. Conversely, those sites sampled early in the hosts pupal stage would be done before all hosts had been exposed to the parasite.

Table 3. Parasitism by native insects during 1977 and 1978.

Area	Parasite	Number Reared		Percent Parasitism	
		1977	1978	1977	1978
Boulder	*Scambus transgressus*	0	6	0.0	1.3
	Gelis tenellus	1	2	0.8	0.4
	Spilochalcis albifrons	1	1	0.8	0.2
	Dicladocerus nearcticus	0	1	0.0	0.2
	Mesopolobus verditer	0	14	0.0	3.1
	All	2	24	1.6	5.2
Locke	*Scambus transgressus*	0	2	0.0	0.4
	Itoplectis evetriae	0	2	0.0	0.4
	Pristomerus sp.	0	1	0.0	0.2
	Mesopolobus verditer	0	10	0.0	2.1
	Gelis tenellus	7	0	4.4	0.0
	All	7	15	4.4	3.1
Twin Lake	*Scambus transgressus*	0	1	0.0	0.2
	Spilochalcis albifrons	6	1	6.2	0.2
	Dicladocerus nearcticus	0	1	0.0	0.2
	Tetrastichus sp.	0	1	0.0	0.2
	Mesopolobus verditer	1	13	1.0	2.9
	All	7	17	7.2	3.7
Disautel	*Mesopolobus verditer*	0	3	0.0	0.7
	Spilochalcis albifrons	4	0	2.8	0.0
	All	4	3	2.8	0.7
Sullivan Lake	*Bracon pygmaeus*	0	1	0.0	0.2
	Spilochalcis albifrons	1	2	1.8	0.4
	Dicladocerus nearcticus	0	2	0.0	0.4
	Habrocytus phycidis	0	1	0.0	0.2
	Mesopolobus verditer	0	3	0.0	0.7
	Gelis tenellus	1	0	1.8	0.0
	All	2	9	3.6	1.9
Friedlander	*Spilochalcis albifrons*	7	11	6.2	28.0
	Mesopolobus verditer	1	2	0.9	0.5
	Gelis tenellus	2	0	1.8	0.0
	Tetrastichus sp.	3	0	2.7	0.0
	Habrocytus phycidis	1	0	0.9	0.0
	All	14	13	12.5	28.5
Sheep Creek	*Mesopolobus verditer*	1	17	0.7	3.8
	Gelis tenellus	1	0	0.7	0.0
	All	2	17	1.4	3.8

Area	Parasite	Number Reared		Percent Parasitism	
		1977	1978	1977	1978
Cottonwood	*Spilochalcis albifrons*	1	2	0.8	0.4
	Mesopolobus verditer	1	6	0.8	1.2
	All	2	8	1.6	1.6
Loup Loup	*Spilochalcis albifrons*	-	8	-	1.8
	Spilochalcis leptis	-	4	-	0.9
	Dicladocerus nearcticus	-	12	-	2.7
	Mesopolobus verditer	-	13	-	2.9
	All	-	37		8.3
Cottonwood Creek	*Spilochalcis albifrons*	-	3	-	0.9
	Mesopolobus verditer	-	2	-	0.6
	All	-	5	-	1.5
Orient-Cummins Rd.	*Dicladocerus nearcticus*	-	1	-	0.2
	Mesopolobus verditer	-	6	-	1.3
	Spilochalcis albifrons	-	5	-	1.1
	All	-	12	-	2.6
Orient-Camp Creek	*Mesopolobus verditer*	-	2	-	1.0
	Spilochalcis albifrons	-	1	-	0.5
	Bracon sp.	-	1	-	0.5
	All	-	4	-	2.0
Kettle Falls	*Mesopolobus verditer*	-	4	-	0.9
	Spilochalcis albifrons	-	14	-	3.1
	Spilochalcis leptis	-	1	-	0.2
	All	-	19	-	4.2
Republic Hall Creek Road	*Mesopolobus verditer*	-	6	-	2.2
	Spilochalcis albifrons	-	2	-	0.7
	Dicladocerus nearcticus	-	1	-	0.4
	Habrocytus sp.	-	1	-	0.4
	All	-	10	-	3.7
Westfork Sanpoil	*Spilochalcis albifrons*	-	8	-	2.0
	Tetrastichus sp.	-	1	-	0.2
	Mesopolobus verditer	-	4	-	1.0
	All	-	13	-	3.2
Republic-Swan Lake	*Spilochalcis albifrons*	-	12	-	4.8
	Tetrastichus sp.	-	2	-	0.8
	Gelis sp.	-	1	-	0.4
	All	-	15	-	6.0

1/ Not sampled in 1977.

RECENT SURVEYS BY OTHERS

In a separate survey during 1978 on the Colville Indian Reservation, similar results were observed (Crabtree 1978). Surveys on 5 *A. pumila* release sites scattered throughout the Reservation found *A. pumila* on one site with a parasitism rate of 1 percent. *C. laricinellae* was found on 3 of the 5 plots with parasitism rates of 1, 3, and 14 percents. No *M. metalarus* or *E. argissa* were found during the survey.

Percent parasitism by native parasites were also similar in this study.

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